taken for all types of solutions, whether they be network based solutions or handset based solutions. The idea was that it would try and stress each one of these types of solutions, in other words, find the worst case of conditions where these solutions were going to perform.

And there is now at least a very comprehensive document that was developed primarily that's been used in the SnapTrack trials. And the Tampa results that were referred to did follow that particular test plan. And it's interesting to note some of the comments that are being made about the deficiencies of the results from that particular test program.

What I would ask from the people who have network overlay solutions and again, when we put together this test plan, we did try and think of particular environments where we were really going to stress their systems and we were talking about environments close to cell sites, for those who have two site solutions and three site solutions.

Can I ask each one of the network overlay providers whether they will be producing a set of results that conforms to that particular test plan. Or, if there is such a document right now, and as I said, this is a very comprehensive document. It goes through and addresses in building specifically as a category. So what is the yield and the accuracy for in buildings alone? What is the

accuracy in rural environments, specifically for rural environments? What is the accuracy close to a cell site, just close to the cell site of the design category? So I'd like to hear from each one o the network overlay vendors if they will be providing that type of document.

MR. KAHAN: This is Dennis Kahan from SigmaOne. I have not seen this, your particular document, but we would be happy to provide that type of information.

MR. CHADNEY: Excuse me, this was a CDG test forum that actually put this paper together. SigmaOne was actually invited to attend these conference calls in putting this together. I will say that is the case for every single network overlay vendor.

MR. KAHAN: I appreciate that. I personally have not seen your document. We would be happy to provide information, a base on that kind of data.

MR. MALONEY: This is John Maloney from KSI. We also have not yet participated in any official CDG tests. Our tests so far have been on a relatively small scale. We're currently in negotiations or discussions with major carriers for large tests at the end of the year. But our tests have been conducted, say, for the last nine years in the area of our operations and the statistics have been calculated and reported as in the docket now.

We are expecting to be externally audited and to

operate in the way in which GTE and others have written test plans, as well as CDG.

DR. HILSENRATH: Oliver Hilsenrath from U.S. Wireless. I'm surprised we know about the requirement. We were part of the forum that set the requirement. We're part of the CDG test group at Bell Atlantic and we're testing according to that document and most of that information is available. Excerpts I tried to present today in my presentation.

MR. STILP: Lou Stilp, TruePosition. TruePosition is participating with the CDG in developing a network based location test plan. P.J. Louis and Matt Ward, who are standards people, are involved in that, so I think Mr. Chadha is aware of that.

TruePosition actually does a fair amount of testing under the condition, although I'll admit it is with amps and TDMA phones, which have differing characteristics than CDMA near the base station. When we deploy a network and the network is displayed over in the corner there in the real time, the 125 cell sites in Philadelphia and the 70 in Houston all have phones not just at the cell site, but inside the cell site. One of the ways in which we monitor performance of the system is that every ten minutes, in some cases, or every 30 minutes, these phones register and they are monitored 24 hours a day.

Now, a phone in the cell site has the interesting characteristic that it is directly under the antenna beam of the cell site, which makes it in possibly the worst position for that cell site. And then, of course, by being in one cell site, it is the maximum distance from all the other cell sites that surround it, and so we think it's actually kind of a worst case placement for a phone, when one considers how network solutions work.

And so, we recognize that CDMA phones perform a little differently and that the power gets turned way down. And we will admit that with CDMA network based solutions, there is an area that surrounds the cell site, very, very near to the cell site, where it's possible that that phone cannot be heard in spite of the 30 db processing gain that we have, that it cannot be heard at other base stations.

And so, we have actually produced coverage plots that show that in something like 99 percent of the area of the CDMA system, we believe the phone can be heard at three and two different sites and location can be calculated very near to the cell site. There is a point where it will fall off. But amps and TDMA have been very successful in those environments.

MR. CHADNEY: Okay, I would just like to reinforce to finish this particular question, because like I say, I've got two others, that all of these network overlay vendors,

as far as I'm aware, were aware of this document. I have not personally seen anything that conforms to that test plan from any network overlay vendor now. And this is one month after AirTouch put out an FRI specifically requesting accuracy information under various conditions.

MR. SUGRUE: What is the significance of being near the cell site?

MR. CHADNEY: That brings me onto my second question. The situation with being close to a cell site for CDMA is the fact that CDMA systems self-interfere with one another. It interferes with itself, and the principle behind this is that what CDMA is trying to do is be spectrally very efficient and that's why you have a one to one reuse. And what that means is, if you're reusing the frequency in every cell, it means when you're close to a particular cell site, other sites that are neighboring can't really see that mobile because, obviously, if it could do that particular mobile which is being served by the cell site that it's close to, is going to be interfering with those surrounding cell sites.

And that's why these TDOA systems and AOA systems inherently have an advantage with amps, because amps is fundamentally spectrally inefficient and therefore, as we move to -- and this isn't just CDMA, this is going to apply to GSM as well and also with TDMA, when they start using

things like power control based on error rate. Spectrum efficiency is going to get a lot better. So I just have a general question as to, you know, what is the performance for these, of these systems, when you have very high spectral efficiency and, say, one to one reuse in the system?

MR. MALONEY: I might also interject some experience we've had recently. Actually, over the years, we've seen performances change significantly. We've noticed in recent times that like CDMA transmissions which we are not currently at this instant processing, and others are, with TDMA, we find aggressive power control going on very rapidly down to Level 10, when the phone gets near to a cell site.

And so, the power control issue is not just a CDMA issue. I mentioned earlier that our solutions do include single site processing and have, and they integrate whatever information we get. We're surprised to find, in fact, that it doesn't come into play more often. As Lou mentioned, and Oliver, if a call goes through, you get a location. And even more so, the signal processing gains that anybody can institute in their signal processing apply to the infrastructure approach as well as any other, and with the signal processing gains, we get that perfectly usable, location related measurements at multiple sites, even though

the communications cannot be established between all those sites. The communications only have to succeed to a single site. The location calculations can still be successfully performed at multiple sites.

MR. STILP: But there's an interesting balance to consider here and that is that the closer that a phone gets to a cell site, even if the power is getting turned down such that a three-site or two-site solution can't locate it, the closer it gets to the cell site, of course, then the more valid Phase I information is, right, because by definition, you're right next to the cell site. So it's not like there is no solution at all.

As Mr. Soliman pointed out, there is going to be areas and situations in which every location technology has a weakness. And with CDMA in particular, there's no question that very near to the cell site, but where Phase I is most valid is where it becomes most difficult for three site and two site solutions. But we emphasize we're talking, you know, in many cases, hundreds of feet from the cell site and so that is how close can be.

MR. CHADNEY: Okay, I would just like to again follow up on this specific point in that I haven't seen any data that has actually quantified how big that particular area is. And again, this is in light of AirTouch putting out an RFI specifically on that information within the last

couple of months.

So my third question relates to the antenna arrays on the base station where these measurements have been taken. As probably everybody in this room is aware, carriers are under a lot of pressure these days to reduce the unsightliness of their sites. They're under a lot of pressure not to put up more antennas. Some CDMA, some carriers now have PCS spectrum. For instance, Air Touch in Los Angeles, we already have antenna phones up, amps and CDMA. And one of the ways that we're looking at to try and mitigate the effect of having to put up more antennas for PCS systems and generally, sort of smaller cell sites as we continue to expand on network, is to use cross-polarization.

And in these situations, we have antenna clusters that are very small. You basically have three antennas for separate sites, but just strung on the top of a pole, which is very different to what we see now with a lot of cellular antenna sites, where we have basically some cases, six receive antennas, typically sort of three meters apart or so, strung around the triangle. And I just wanted to ask the network overlay vendors to what extent their tests have been done with cross-polar antennas in a configuration that is, say, representative of equipment that is now beginning to be rolled out extensively by carriers? And that is, you know, the pole, single pole with three cross-polar antennas

on the top of it, back to back.

MR. KAHAN: SigmaOne has not tested that configuration.

MR. STILP: I guess two comments on that for TruePosition. One is, of the approximately 200 cell sites we're now deployed, there's not a single antenna that was added to any one of them. So we're using in all cases, the existing antennas on the cell site.

Specifically with respect to cross-polarize, we only did one set of testing, quite honestly, and that was four years ago in the City of Philadelphia, where we were comparing the results of spacial polarization, which is what most cell sites currently are, to cross-polarizations, which is what Mr. Chadney is asking about right now.

And there's actually a minimal -- in those tests, which admittedly were four years ago, we saw minimal difference. The reason you do this, of course, is to help combat relay fading, so presumably the antenna configurations you would deploy in the future would have at least the same effect for relay fading as your existing, spatially polarized ones.

MR. CHADNEY: Right, one of the points I was getting at there is that, particularly for systems that are exploiting time difference of arrival and not angle of arrival, if you're relying on that spacing between diversity

antennas, to give you some type of time difference of arrival, then that's going to go away if you've got cross-polar antennas.

MR. STILP: We do not rely on the spacing of the antennas. We rely on it for the same type of multipath mitigation that the base station is looking for, as well.

MR. KAHAN: SigmaOne also does not rely on that spacing for the issues that you raised, at all.

MR. SUGRUE: If I could just interject, if you don't mind, Tony, so your answer to the question is there's no antenna impact from implementing your system, at the base station?

MR. STILP: That is correct.

MR. MALONEY: Certainly, the TDOA approaches are applicable with just a single omni direction or a single cluster element. The directional approach is used so-called phase arrays or multi-element rays, and they depend upon some spacial separation among the receiving elements.

The antennas we have used have not even been connected with a cellular system. As I mentioned, we've been operating totally stand alone or as an entirely independent overlay. Our antennas have used elements that are about halfway length apart, so they're about that far apart. They occupy about -- and, about that high. So they aren't very big, and they would fit physically within the

same volume or as a part of a cross-polarized antenna. But you do need some directional sensitivity in order to exploit angle information.

If you're going to take advantage of both angle and time information, then you need some directional sensitivity, and our antenna elements are very small and would fit very easily in the volume that is provided. Certainly with the spacial diversity, you can use the antenna elements that are out there, and Oliver certainly has been doing that, too, also exploiting the spacial separation of the elements.

DR. HILSENRATH: Well, with the ease with which we were able to lay out our equipment with existing cellular operations was primarily because we didn't require any type of changes on impact to the variety, whole variety of antenna arrays that cellular carriers are using. And I would say that in general, I haven't seen two identical sides between the several attempts that we have rolled out throughout the country.

So there is a site design issue that comes with location as well as with any type of wireless operation that would be rolled out. We didn't see limitations between that spread of designs to our system, but it should take into -- or should be clear that in rolling out the nationwide location capability, there will be site design issues, the

same type that carriers are experiencing all the time.

It's a natural for network design, although I would say that in our experience, we were able to conform with whatever the carrier had, in most cases, except of maybe cases in which there was a singles to contend on, on which we needed to add some.

Otherwise, we operated with very sectorized antennas with on site, with rural type of on site. I do not anticipate that the cross-polarization issue is going to impact us, although we haven't ever seen a site like this as Lou said. And the major parameter that is important to U.S. Wireless in our strategy is more the site layout aperture, rather than the way the antennas are organized. As long as there's a spread of three feet of one meter, we don't anticipate problems in rolling out the system.

MR. HATFIELD: We probably need to -- I was going to come back to that. Go ahead, please.

MR. NIXON: Jim Nixon, Omnipoint. One issue that I think will become more apparent as we move into Phase II is the impact of zoning restrictions on tower sites. There's a lot of comment in the record that network solutions have problems near the fringes of their coverage area, and I think that we need to also consider the impact of zoning prohibitions and county-size areas or large areas that would effectively create a blank area in which the

carrier would never be able to comply, using a network solution, given the zoning limitations. And I'd like to suggest that at some point we consider how compliance would be measured in those situations, if it can be demonstrated that that's what the impact is.

MR. SUGRUE: And just to pick up on what Mr. Birchler said earlier, this is situations where there is a communications link. It's a conditional probability, but unable to establish the location.

MR. NIXON: Correct, but at the edge of the coverage area, if you're relying on three antennas to make your location calculation, you're going to have more trouble getting those three antennas, depending on a whole range of variables that we have here.

A zoning area, where you essentially have in the middle of an otherwise good footprint, a large hole that's been created by zoning prohibitions, you'd be artificially creating a boundary of the network, where you may not be able to get sufficient antenna connections or communications to actually determine your location.

If you had sites within that area, the problem will completely go away, because it will then be within another good footprint. So just a consideration that another impact of the zoning issue.

MR. KAHAN: If I could respond to that, because

it's actually a very good point that Mr. Nixon is making. First of all, when we talk about fringe areas, there's two kinds. One is, the fringe of one system is frequently the beginning of another, and so, where one carrier is hitting a fringe, there's obviously the opportunity on the other side to complete the loop, complete the circle, so to speak.

The second thing to consider is that location of receivers are not full base stations and that the antennas, if one had to add kind of an auxiliary receiver somewhere, it does not have the same kind of antenna mounting and all the power requirements and the cell site requirements that a standard base station does. And so, it is entirely possible to be creative in finding solutions for truly fringe areas where there is no cellular coverage beyond that, in completing the circle with auxiliary receivers. I mean, there's a percentage of cases where that might be the creative solution that one applies.

MR. SUGRUE: The cellular receiver would be there just to provide the location?

MR. KAHAN: Yes, it would be there solely -- location systems are receive-only. They don't transmit, and so if I were going to mount an antenna only for receiving, I'd mount a much smaller, very different antenna than one might use for a full blown cell site. So the antenna can be much smaller, much more unobtrusive, perhaps, than another

type of tower, such as a paging tower, an FM tower. And again, it would be there just to complete, you know, the two site or three site solution needed for that fringe area.

MR. NIXON: And I would suggest that that would be good for those solutions that don't necessarily need to have a one to one relationship between sites and antennas, but in order to maintain technological neutrality, I think we need to also consider the other perfectly valid solutions that may not require just a separate, or would not be able to use a separate location.

MR. MALONEY: I also would like to point out, we never rely on three antennas. There's a significant misunderstanding. People have claimed three are needed. They are not needed. We have produced results from a single site. Oliver does. We produce them from two sites routinely, and we operate at distances that people can't conduct communications at. So it's not always clear, and I certainly agree with Lou that the antennas for location are not obtrusive, big, etc. Ours are quite small.

MR. NIXON: There are a number of zoning boards that would probably disagree with that.

MR. SUGRUE: Maybe we'll make it an over the air reception device and just -- no, just kidding.

MR. SMITH: I'm Tony Smith of Nortel. I'd just like to add to something that Mr. Nixon said and, perhaps,

also indirectly, to a point Ron Rudokas made. I guess I'm concerned about some of the economics. You know, you can always achieve accuracy and you can always achieve the right yield if you spend enough money.

We do a lot of proposals for various carriers such as Nortel Networks. One of the things I'm seeing is a large amount of highway build out, which is quite linear coverage. Certainly, the opportunity of triangulation is not there. While it may be true, somebody mentioned a number, that 5 percent of cells in a mature cellular network, only 5 percent are paired and in the remaining cases you could have triangulation, that statistic would not be true of an evolving network, as yet immature.

So we're seeing a lot of highway build out where you're going to have pairs of cells. You're not going to be able to triangulate, but if you do, your economics will be shattered, adding potentially 30 percent incremental cost to achieve that build out economics. That would not be practical, and Mr. Rudokas also makes the point about rural coverage, where he may only have a single cell.

I think what we need are yield estimates and accuracy estimates for one cell situations, for two cell situations and for three cell situations. And I think we need to have those published and I think we need to have the test conditions clearly articulated, so that we understand

the antenna heights, the antenna types, etc., so that we can take some of the myths out of -- or misconception out of the situation we have.

MR. KAHAN: Dennis Kahan from SigmaOne. SigmaOne does use a hybrid system, which allows us to develop either TDOA, if there's an antenna problem, or we can deploy AOA, or we can deploy both of them. Because of the fact that we use two technologies in that highway situation, in particular, when you have two technologies, you can use AOA from most of the antenna sites that are receiving the signal, plus a single Time Difference of Arrival measurement, which creates a hyperbolic line which intersects at approximately 90 degrees to the vehicle or the phone that you're trying to track. So we don't have a problem there.

What is very interesting about the tenor of the conversation is the absolute insistence or the desire on the part of carriers and infrastructure manufactures, that I think is good, to locate every single phone that is out there. What's fascinating to me is that when you look at the network based systems, when you deploy one and I'll just use an example -- you deploy in Los Angeles County, you deploy and you cover 1.5 million or two million subscribers on day one. How long is it really going to take for the handset manufacturers to deploy and cover 1.5 million

subscribers, since, after all, that is the goal that everyone is trying to reach?

The thing that I find disappointing is that the carriers in particular do not want to commit to covering all of their subscribers. They either want to do it in good faith or they want to have very loose deadlines. Those kinds of things don't jive to me. Either you care about all of them and you care about them all on day one, or you don't. And to try and attack the network based systems and say, well, the network based systems are not perfect, they are not perfect. But to attack them to say that you're missing 2 or 3 percent of the coverage or 1 percent, or you can't get someone very close to a cell site may absolutely be true. And the network people are always working to improve their systems.

But look at the reverse side of the coin. If you look at what NENA is trying to do, for example, and you try and analyze the absolute desire to, as quickly as possible, cover all of your amps customers, cover all of your TDMA customers, GSM customers or CDMA customers and do that on day one, how many more lives will you save than if you implement a waiver regulation that basically says, well, we believe in rapid deployment, but don't hold us to it. We want to do it in good faith.

I think there's a real big dichotomy between

trying to nail network people on deficiencies on their systems, and then at the same time holding up your hands and saying, well, we're going to deploy when the marketplace let's us.

MR. SMITH: I would really like to respond to that comment, because I don't think it's a question about who's trying to get who. It's a question of trying to get to the facts. If we, as equipment suppliers, and I'm speaking for Nortel Networks, if we are to support a given approach, it is because of two reasons. One, because we believe it works, it can comply with the FCC requirements, and it's been proven to be compliant, and number two, because our customers believe it will comply to their needs, as well.

So in a sense, we're the piggy in the middle. We're not out to get anybody. We're simply asking for the right evidence to be put on the table so that we can all make sensible decisions.

By the way, I want to emphasize another point. Given the even horizon, and I'm taking October 1, 2001 as being real, given that some of the solutions require self-site modifications, given that standards will not be issued until Q1 of next year, it's about time we got those details out on the table so that we can actually, by the time we have the standards, make sensible decisions to start moving forward with solutions to the marketplace.

MR. MILLER: Bob Miller, NENA. I'd like to go back to the first question that the deputy chief said, if anyone remembers it, are there any other solutions? There will always be other solutions and today we're talking about good solutions, better and best. And some of these may be better, some may not be as good. Some may be less, some may be more.

But you know, we're here. This is kind of a subset of what 94-102 is about. And I remember the area of the meetings we had in '94 when we drew up the weight paper, the CTI in the industry. And the whole goal was to make wireless 911 as compatible with wire live and PBX as possible. And several states have demonstrated systems, some even demonstrated them within a year of the ruling. And we have people that say, we can't do this thing in 2001. People have asked for waivers that haven't tried things. And there are companies that have made things. There may be companies that can do it better. We all hope we can get into a Phase III.

But you know, in the four hours that we'll spend here today, I calculated 20,000 911 calls. I mean, we have 74 million subscribers, we have 110,000 calls a day. It's hard for me to wrestle with neutrality, but I can wrestle with public safety neutrality. And who's going to answer for these people, these calls, and we have to locate these

people. Let's keep in mind, it's not only a case of locating them, it's what it's done to our PSAP when we spend all this additional time trying to figure out where they are. It pulls down our full service from wire line 911. And I think we need to move forward.

I mean, the FCC has asked in these general comments what they can do. I think we need to halt the dates and move forward. And I'm sure we have a lot of good handset technology that's going to come. Maybe some will come by 2001, maybe some will come later. But I think we have to really focus on public safety and move forward.

MR. HANNA: I'm going to refocus on some technology issues here, at least Bob and I get into a tussle here. One question, I guess, for all the manufacturers here, the providers, there were different issues presented here in terms of the time frame in which it might take to answer certain calls at the PSAP. I guess the question for each of the E-OTD providers would be whether the data you've assembled so far represents calls that have come in from cold starts, for the subscriber who has the phone in the glove box, they pull it out and turn it on, or is that from a tracking mechanism? Then there's a follow up to that, but I'd like to have that question answered first.

MR. KAHAN: SigmaOne locates from cold starts. We locate on the reverse control channel signal, which is a 100

millisecond burst in amps and it's somewhat shorter in TDMA, about 20 milliseconds. So we locate instantaneously. We don't even need the voice assignment to be done before we know the location.

MR. BELL: Walter Bell from SnapTrack. We always use cold start first fix in all of our test data.

DR. HILSENRATH: So do we at U.S. Wireless, testing a whole variety of handsets, in any type of conditions, in buildings, outside buildings. And in general, we're very open and we believe that we're one of the largest players in the location developer community.

We encourage members of public safety to pay visits to us and our colleagues here and to witness the way they're being trialed while they're in conjecture.

MR. SOLIMAN: Samir Soliman from QUALCOMM. We always position the phone during call set up or just after call set up. And by definition, assisted GPS is a warm start.

MR. CHADHA: Yes, this is Kanwar Chadha from Sirf. As was said, in a wireless assisted environment, you really never have a GPS cold start, because GPS cold start means you have no information at all, whether satellites are visible or whether they exist or not. Typically, cold start in a wireless environment will be more like a hard start by traditional GPS means.

In autonomous mode, you can have a cold start and cold start or relatively warm start, and warm start time will be about 38 seconds, compared to three to eight seconds if you did a wireless assisted start.

I would also bring up one more question, I mean, one more point referring to the previous speakers. I think we need to keep the morality of the situation somewhat out of it.

(Laughter.)

MR. CHADHA: I mean, we are not a socialist country. We have to look at what makes economic sense and we have to pick our technology based on, you know, not saving the last life, but in the long run, where more lives will be saved. And I think it's important to keep in mind the accuracy achievable in the long run. GPS technology is there today. It has been a proven technology. The key question is not whether the technology is there or not. The key question is whether you put it into the handsets or not and that, to a certain extent, is determined by the directions carrier dates, the directions FCC gives them.

It's very difficult to assume that in one day, you will have 260 million or 270 million of U.S. covered, suddenly with either network based or GPS based technologies.

Infrastructure is more difficult to change than

handsets.

MR. BELL: This is Walter Bell from SnapTrack. I just need to clarify the cold start, warm start. I think we're getting caught up in semantics between a GPS terminology and an emergency location terminology.

Nothing has been said that's wrong about warm start and cold start, but I just need to clarify that part of the tenant of the SnapTrack architecture is that the server technology, the server architect provides warm start type of assistance information to a cold start scenario. So it is true that we are operating from a GPS perspective we could put into a warm start mode because of this aiding information that comes from the server. But to the emergency locate perspective, it is cold start. The phone could be off, the GPS equipment is all off. There's no prior knowledge of location.

MR. STILP: I don't want Mr. Hanna going home without knowing TruePosition locates its first attempt on each call on the initial control channel burst and then will switch over to voice channel tracking, so in two to three seconds, we have location.

MR. HANNA: If I could do a follow up question, though, several others in the room had the privilege of being at the House hearing several months ago when the House bill on Wireless 911 was passed and we now have Senate Bill

800 pending. One of the issues that was addressed in that bill had to deal with privacy issues. I guess one of the items I'd like to address from the various providers is the ability, I guess, as to whether you are constantly locating or you have the ability to locate a caller, you know, at will, or is this solely on the activation of 911?

DR. HILSENRATH: Yes, I would like to discuss the topic a little bit. I think that there has to be a little bit of a better understanding of what the network solutions are going to do and what they're not going to do. There's this feeling that there's going to be this nationwide network that is now going to listen to everybody and locate everybody.

However, the location overlay is able to track radio events. Those radio events have to be identified by somebody that will tip off a network like U.S. Wireless or other people's network. Who, what is the identity of the person that was assigned that channel? That function is always performed by the carrier and we anticipate it will be always performed by the carrier, as long as, for example, that U.S. Wireless Network is out there, locating radio events, the association of those events, with the subscriber that actually made the call, it's totally in the hands of whoever is controlling that identity, which is the switch.

So generally, there's no ability of network

solutions to dive into the privacy of the subscribers more than any other type of solution. In general, there's one place where our entire privacy needs to be safeguarded, and not only location. It's identity, it's content and it's location, and all of those events are being controlled by the switch. As long as that function is handled well, there's no difference in privacy handled by a network or handset solution.

If I might take the opportunity of making another couple of comments, I was actually very excited to hear at what extent infrastructure manufacturers and carriers are preoccupied by the fringe areas of location service, because it means that it feels like there's commitment out here to make it ubiquitous, to make it work everywhere. Highways, fringes of service areas, it feels very good as a location provider to feel this type of commitment.

It escapes me a little bit how can that be handled with all that care by potentially not doing location altogether and waiting a decade for that capability to roll out in the market? So if we are, indeed, preoccupied with how every highway is going to be covered, if every fringe will be covered, how rural areas will be covered for location, we should also think of the fact that if we steer the wheel here the wrong direction, highways, fringes or downtowns might not have location for the next decade.

It's a curiosity for me with a whole number of big handset manufacturers around here that we don't hear any commitment or any mentioning from one of the handset manufactures as where do they anticipate that I will be able to buy the first Snaptrack or IDC-equipped handset in the market, so we can start discussing how these are going to be handled that way? Is that a question that we can answer, maybe?

MR. O'LEARY: Can the carrier answer that?

MR. HATFIELD: Yes, sure.

MR. O'LEARY: From our perspective -- Eamon O'Leary, AT&T Wireless -- we're certainly working towards that one day, however, I believe the technology is still evolving and we want to choose the best solution.

Now, I believe we've heard from eight or nine different people here today and I think if you ask them, they will have chosen eight or nine different criteria to measure compliance. So some help with that would certainly help us with making a decision.

Also, I think one of the things that I have not heard from here today, which is something that concerns us quite a lot, actually, is how to maintain the performance of the system in the real operation environment? We've heard from several trials that were done in very controlled environments, but trying to operate and maintain a radio

network is a very difficult thing to do. And we want to be able to maintain the performance and the accuracy of the system ten years from now, as our network evolves. And as our network is getting more sophisticated, we're implementing things like the automatic power controls, the automatic channel allocations and things like that, and I'd like to hear from you how your system will handle those kinds of things or if they have to be handled manually. They're not integrated with our existing infrastructure. We don't have the alarms integrated with our existing infrastructure.

How difficult is it for us as an operator going to be to maintain the accuracy of the system in an automatic channel allocation power control, not an alarmed environment/

MR. STILP: If I can answer the question, I feel like they're stacking up faster than we can get them all answered here. Lou Stilp, TruePosition. TruePosition's system, as I mentioned earlier, can go out and sample as many as 192 different antennas. So every location that is calculated -- that is, if somebody dials 911 and hits the send button, radio waves radiate in all directions, and they're received at an awful lot of different antennas, except in this room, of course.

And the system dynamically samples everyone of

those antennas and determines for that one particular call which set of antennas are the best ones to use in order to calculate location for that one particular call. If you were to make ten calls in a row, standing in the same spot, you may not get the exact same set of antennas all ten times. So there is a fair amount of dynamic calculation that goes on inside the system, based upon real life measurements.

There is one point that is manual now about TruePosition's system. That is, when it comes to knowing which control channels are assigned to which cell sites, that must be programmed manually in. However, based upon a contract that was signed and announced earlier this year, with at least one vendor, Ericsson, TruePosition and Ericsson are working on dynamic links between the two systems, in which every time a carrier makes a change to the control channel, frequency allocation, those changes are automatically downloaded into the TruePosition system.

And to the last point that I heard Mr. O'Leary mention, that when it comes to dynamic or automatic channel location, that is primarily a voice channel issue. That is, once you've gotten off the control channel onto the voice channel, if I'm correct, isn't that right, all voice channel information, when TruePosition tracks on the voice channel, the information about which voice channel is currently in

use by the subscriber comes directly from the switch. That is the subject of what is going on in Tier 45.2 at the Emergency Service Group and also the subject of a joint development effort between Ericsson and TruePosition. So with at least one vendor, we're kind of blazing the trail on solving the problems Mr. O'Leary has mentioned.

MR. O'LEARY: How about the other vendors? RF fingerprinting would be one we'd be particularly interested in.

DR. HILSENRATH: We're by and large, a traffic channel system. So we're not paying attention to the control channels. That is not a feature that would affect us. We're expecting, as Lou said, to have the right link to the carrier such that it's been pointed out to us which channel needs to be located and the identity of that channel, therefore, we are totally insensitive to the change of frequency plan of the carrier in that specific market.

The changes that would affect us and that leads us to the default issuance issue that I think we need to discuss is potentially if a carrier overnight decides to dismantle a base station in which a radio camera is installed and therefore, there are no antennas anymore to access.

But overall, we're looking at the totally independent overlay. They can be co-located, but totally

independent, and the information we need is really the one that is associating which caller utilizes what channel in order to be able to handle the traffic.

There is, in both your questions, in Ron Rudokas' question at the beginning of the session, I think, a key issue which is, how do you maintain the quality, how do you audit the performance of your location system in a market? That's a serious topic to be addressed, due to all the changes that could be in the market -- towers, construction, frequency allocations, etc.

That is definitely a topic that needs to be handled, I believe, quite similar to the way the carrier is maintaining its own operation. U.S. Wireless has a process that is really indigenous in the system, in which there are a small number of anchors in most of the markets today one, that are roaming and calculating on line as they are traveling, the accuracy of the location system, everywhere they're roaming within the network.

So at the end of each of these drives, U.S. Wireless can state what is the location performance in any single location in the street. This is the type of review that I think is going to be necessary. Location is not going to -- we do not want location to degrade, knowing that there's probably safety riding on that performance. So we're building that capability as part of supporting, of the

operating costs, if you want, the operating strategy of a market.

MR. SUGRUE: Mr. O'Leary, when you asked about long term network maintenance and it would have to be in place and what not, you seemed to be looking more at the network people. Is it differentially a network issue?

MR. O'LEARY: Correct, trying to maintain -- it's almost a separate radio network they will have to maintain, and we'll have to maintain accuracy for that network, as well. And the radio network that we have today has evolved quite a lot over the years, so a lot of the functions have been automatically built in that were manual years ago. So before, when the RF engineers used to go over and tweak it manually, now it's done automatically and the links are built into the network systems that I know of to sink them up. And that's, that would mean then that the location system could fall out of -- gives the wrong values.

MR. BELL: This is Walter Bell from SnapTrack. I think it's just important to point out that this has been a good discussion, because I think it shows that there are substantial ongoing costs associated with network based solutions. I'd just like to point out again that we have a $7 to $10 first generation initial implementation cost added to the handset. That's it for the cost and then as the technology rides normal technology curves, that's going to

drop dramatically. This is not an overlay's second radio network that's going to require a lot of additional costs and maintenance over time. It's a one shot cost.

There was also some questions about privacy, which I don't think anyone from the handset site got a chance to respond to. Handset based solutions inherently have the capability for privacy. You can turn off the location feature if you don't want to be tracked. It's very easy, then, to have a 911 call override that, because by dialing 911, just as with a wire line network, you're saying it's okay to locate me. So an override is certainly reasonable there.

And then, finally there were questions about where the handset manufacturers in terms of handset based solutions -- let me say for SnapTrack and we have the privilege of working with two outstanding handset manufacturers already, that they are already working on the semiconductor parts. They have programs that would put the first generation of parts available to build in the handsets that are reasonable integration costs in the first half of next year. And that can drive handset availability by the end of next year, early the following year. And I think what would really help those handset manufacturers was some indication from the FCC that, indeed, handset based solutions are going to be allowed to compete for this

technology solution.

MR. MALONEY: This is John Maloney from KSI. Relative to normal operating costs and requirements, for example, for maintaining calibration and things like that, we don't have experience with the time synchronization standards, for example, that Lou has had to work with so far. But it's certainly true that when you're doing angular processing on phased array types of analysis, there is some calibration involved. I will say, I expected it to be required much more often. We have -- the last time we calibrated our general operational area and our Northern Virginia headquarters area was six months ago, and that's still working fine.

So there aren't continuous, say, tooling and adjustments that are required, and it's turned out to be much more stable than one might have guessed. Relevant to privacy, I would say that's a fairly specious argument that's been raised to networks. Any forms of processing that's dealing in private information has authentication and authorization procedures. Our does today. There's nothing private about a cellular call, as we found out, unfortunately. It's illegal, but it's technically possible and it's been illegally done. It doesn't mean it can't physically be done. It's not authorized.

We don't expect that the distribution of

identified location information on private individuals, first of all, would be economically useful and secondly, would be legal. It may be technically possible, but it isn't expected to be legal.

Oliver mentioned location information. There's nothing sensitive about that unless it's identified with someone at some time. So in fact, it's the connection, the joint set of information, time, identity and location. For doing normal everyday traffic analysis that our highway departments hope to get away with, so that you citizens can get away with only paying 2 percent of what you would have to to support your own desires for efficient traffic management.

You can do that by stripping all identity information and just figuring out what the speeds are on the highways that are going on. The infrastructure approach supports all that. It supports good, effective communications. You can run your communication system more effectively if you exploit location information, first of all, in tuning your system and understanding where your trouble spots are, perhaps in even doing real time smart handoff decisions. All of those things are possible with infrastructure based information, which aren't possible if the basic location data isn't available.

Finally, I'll just say in my stacked up sets of

answers that I didn't get a chance to get to, certainly, the linear deployment of antennas along highways, there's a prime example where you would have two sites in contact. And as folks mentioned to my right, the combination and integration of time information and angle information is particularly appropriate there. One time measurement puts you on a hyperbola. The angle tells you whether it's on the highway or whether it's the farm laborer on the tractor having the heart attack off in the field to the side of the highway. So the combination and integration of information that I mentioned in the location calculations is the way we implement it. And it's all beneficial.

MR. SOLIMAN: QUALCOMM would like to make some comments regarding the availability of handsets to support the hybrid approach. QUALCOMM has located the resources to insure, if the carriers desire, that all new handsets introduced after October, 2001, comply with existing E-911 mandate specifications.

MR. KAHAN: This is Dennis Kahan from SigmaOne. I'd like to respond to one of the things that does perplex me about handset based approaches, especially the oft-heard claim of the $7 to $10 per part. I mentioned earlier in my presentation that when a consumer goes to buy a computer, he doesn't ask, what do the manufacturer's parts cost for that hard drive? If I said it was $2, would it mean anything to

the consumer? It would not.

The real issue is not the $7 to $10. I think that that number is accurate and I have no reason to disbelieve it whatsoever. The real question is going to be, what about all the other costs? You've got to redesign the handset. You're going to have a brand new handset. Manufacturers are going to want to make a profit on the GPS handsets. They're going to differentiate them. The real cost to the consumer is not $7 to $10, and when someone tells you that it's $7 to $10 or uses that number, it's extremely misleading. The question that the Commission should be asking and I'm sure the question that the carriers are asking is, what is the price that the big handset manufacturers are going to be charging me when it's all said and done and how much more do I have to charge the consumer?

The question I'd like to ask, especially to the assisted GPS proponents, is what can a consumer expect in not very high volumes? What can they expect for the very first unit that is going to be sold, so that you can comply with the early start date? What kind of costs can you expect there?

MR. CHADHA: This is Kanwar Chadha from Sirf. I think that's an interesting question. Not very high volumes, because, by the nature of this mandate, you will get high volumes. And the handset providers will take that

into consideration when they're costing their handsets. And carriers will take that into consideration when they're selling their handsets.

I think there is an assumption made here that a GPS handset, location based technology and handset is somewhat equal to the network based. They are not. A consumer gets more when they get new handset, which they can use not only for an emergency response, but for some other features.

If you look at the trend in consumer buying of handsets today, lot of times carriers are offering them free handsets, but AT&T's example of one plan, you know, one of the most popular forms is the Nokia 6160, which is not a free handset. I think the consumer pays for the capability they get, and that's what you need to keep in mind. If you make the handset smarter over a period of time, subsidy will come from consumers paying somewhat from it, the carrier adding some location services on it, so they can provide more value-related services, which will subsidize the handset. Nobody buys handsets at price today. I agree with you that the $5 to $10 figure we are talking about is the cost of handset. The consumer can probably get it for free.

MR. KAHAN: Does that mean the handset people are waiving the right to cost recovery and that's a totally irrelevant issue so that the Commission can now go write

rules that basically say if you're going to adopt a handset solution, cost recovery is absolutely not required?

MR. CHADHA: No, what it means is that over a period of time, technology has a way of reducing the costs, silicon has a way of reducing the cost. So you have to look at the long-term volume implications and cost the handsets accordingly.

You can't say that, you know, you're going to put it in ten sets and that should create the cost model. The cost model has to be created looking at the long term implications.

MR. BELL: I should add that we are working with carriers in Europe and Japan that have no FCC mandate and yet, they are moving very aggressively to incorporate GPS into their mobile devices and their handsets. They have no cost recovery mechanism. They see their cost recovery as the ability to do applications based off the high accuracy of this system.

MR. RUDOKAS: I think I have to make a comment here. I find it very humorous that a group that does not contact the customer and really doesn't have any way of getting feedback from a customer is so clearly knowing what the customer wants.

I think that it's really the operator's issue. Now, earlier, it was pointed out to us that there are

solutions available. Here are solutions to this problem. Why have the operators not stepped forward and taken advantage of these solutions to provide the additional services and the obvious benefit to the consumer that we can get with the services, as pointed out to us earlier?

I think the issue is that there's really some ambiguity in what it would take to comply with the FCC rules that we have today. The reason you can have operators in Europe moving so aggressively towards this issue is that it's the best effort sort of thing for those guys. They do not have to meet a particular mandate to provide a particular kind of service.

Now, I still, after hearing everything I've heard here, do not understand how I would deal with understanding if I've met the FCC rules. I could do all my testing inside of rooms like this and by God, GPS or handset based solutions will not work.

I could do all my testing using areas that are served by enhancers and the only thing I will locate is the enhancer. I won't know where the handset is. There are a number of solutions. But what is the resolution that are not defined and do not have a solution that would make it possible for a carrier in good faith to deploy a technique or a technology with no guarantee of any kind of cost recovery, because there has been no cost recovery for

anybody to date and no guarantee that, in the end, this solution will truly provide the kind of service that the FCC would like us to provide?

I think that what we need to do is we need to find a way to get some clarification of what it is that we really need to do. How do we know whether we've complied with these particular rules. How do we deal with the issues of reliability, responsibility and cost recovery? How do I deal with the issues of a GPS-enabled handset roaming in a market that happens to pick a network solution and vice versa? There's a lot of issues here that I think there are no answers, but they're not technology issues. We have the technology. We can make this work. We don't know what to do right now. That's the issue.

MR. NIXON: Just a kind of second carrier opinion here. Omnipoint, at this point, prefers a network solution simply because it is available. We can roll it out. We believe the costs are equal to the handset solutions, once you look at all the marketing, consumer education, the distribution chain impacts for trying to swap phones out, trying to identify which customers have the old phones, particularly if there were some mandates put on what dates, specific dates you have to achieve particular goals.

There's a large administrative cost there that I think we need to consider, as well. But that does not mean

that Omnipoint is not going to continue to research and try and find the best possible solutions for ourselves, for our other GSM carriers and for all of our customers.

The comment earlier, I think Mr. Smith made about -- or, forgive me if I've misquoted, but that there was -- he was pleased with the commitment that he sees here from carriers to try and meet 100 percent location capability, rather than the 67 percent. Anyone who's participated in the -- we had the NENA Technical Development Conference, a lot of the discussions that occurred and the various carrier working groups that are talking about these things knows that both public safety and the carriers generally are committed to doing a good job on this as fast as they can. We can do it and we think we ought to press forward with it.

If, however, the Commission decides that it's better for technical neutrality to allow waivers, we would urge you to look at the other issues that grow out of that, particularly the liability issue that grows out of creating a second class of service for some customers who can't afford to upgrade their handsets, even with carrier subsidies that might be offered.

We think there's a significant liability concern there and if the Commission decides to grant waivers, they ought to seriously consider how they're going to provide

liability protection for those claims. I think that my final comment here is that this whole basic issue in 94-102 came down to an economic decision for the PSAPs. They are allowed to request the service, so they start this whole thing, this whole process off, provided that they can use the data and that they can pay for it through cost recovery. They need a lot of help to get legislative infrastructure costs within the land line portion of the 911 network, mapping and other background and support services that are simply not required before you get to this level of sophistication with wireless technology. And I think that we would do ourselves a big favor if we would put more effort into supporting public safety and getting those kinds of capabilities in place so that they can request the service.

MR. HATFIELD: If I could, there's a few people that haven't had a chance to speak here and we're running up on the ending time, and before I did, I wanted to give a chance to people who've not had a chance to speak, that opportunity now. Yes, please?

MR. SRINIVASIAH: Yes, this is Bhaskar Srinivasiah from GTE Wireless. I think earlier on there was a comment made that various solutions are available. It's a matter of determining what works best and a difference of consensus.

GTE Wireless is a CDMA carrier and I don't believe

that there's a network based product today that works in the CDMA environment that one can trial with. GTE Wireless, I think you heard earlier today, that we have been participating, assisting the various providers with solutions to determine what technology works under the consensus. And we'd like to do the same thing with the network based product for CDMA. And I haven't heard any dates and how soon that would be available that we can do that.

DR. HILSENRATH: This is Oliver Hilsenrath, U.S. Wireless. You weren't there at the last CDG event in Baltimore, but your colleagues were there. First of all, U.S. Wireless presented extensive field trials of CDMA radio camera. I'd be happy to, if your colleagues didn't update you, to give you an update of that event.

MR. SRINIVASIAH: We would definitely like to see those results as part of the CDG efforts.

DR. HILSENRATH: Our Bell Atlantic activity is part of the CDG activities, designated trial, as part of covered by CDG, Bell Atlantic happens to be the lead of the location forum there. So I think the statement is incorrect.

MR. SRINIVASIAH: Well, the last time we had talked about this with our colleagues at Bell Atlantic, the CDMA results were not available yet, and this is like three

months old.

DR. HILSENRATH: Baltimore, I believe, the event at Baltimore was in July. You're welcome, there's a GTE network where our offices are, welcoming you to take a look at the results.

MR. SRINIVASIAH: I am definitely encouraged to definitely look at those.

DR. HILSENRATH: Secondly, we also submitted a CDG schedule of the availability of the dual modes for camera and CDMA, under the understanding that the carrier will not be able to roll out one without the other, including the carrier like GTE.

So my message is, network solutions do have -- U.S. Wireless, as part of the network solutions team -- does have a solution for CDMA. I can't see any reason to assume that network solutions are not going to cover CDMA. I think it's a myth and it's behind us already.

MR. SRINIVASIAH: I would like to say that is not the intent of what I was going to say. I'd like to see the trial results, how soon we can get to trial a solution like that from CDMA.

MR. HATFIELD: We're drawing up here on time. Nokia or Ericsson, did you have any comments?

MS. SILLANPAA: Does this work? Can you hear me? So I am Anna Sillanpaa from Nokia. Nokia does handsets for

all these technologies and CDMA IS95 and GSM. And we are looking with all the relevant industries to come up with the best solutions for the carriers and for the great public community.

I just want to comment a little bit about this related to what Omnipoint maybe said. Nokia is the world's second largest infrastructure manufacturer and we have looked very carefully at the policies of the TOA and E-OTD methods. And we see things a little bit differently than maybe Omnipoint. We believe looking at the hardware that is needed and the software, but especially, the differences are greater on the hardware side. So we believe that E-OTD is less costly.

Then, also, on the roaming issues. I would also like to clarify that in most situations, when you use the triangulation method, you still can have additional means to improve the accuracy, even if you cannot have, for example, three or more sites to locate the handset. So the situation is not that you either can locate the subscriber or you cannot locate. You can, with these additional means, you can improve the cell ID quite a bit. So it's not a question that you have location or no location. You will be getting much better accuracy than cell ID in most cases, in any cases, even if the triangulation fails. That's the case for roaming subscribers.

But there are also other possibilities, at least within the global GSM community, the E-OTD has been selected as very widely supported method. So it is very likely that most of the handset vendors will implement it later on for commercial purposes. So it may not be such a black and white issue. Thank you.

MR. HATFIELD: Did you have a final?

MR. CEDERVALL: I'm Mats Cedervall from Ericsson. We started looking at positioning. We followed the regional FCC rules and therefore, we considered network solutions. And in GSM, we have followed the standard session and currently, the network solution is standardized. If that's what our customer wants, that is what we will provide.

As Lou Stilp said for amps and TDMA, we have a networked solution and a joint development with TruePosition. But for CDMA, we see that the network solution can be quite complex and might not provide the performance that is needed. So for CDMA, we would actually prefer a handset solution.

MR. HATFIELD: Is there anybody else?

MR. MONTGOMERY: Bob Montgomery from Nextel. One question we did not have an opportunity to discuss was the location accuracy and one of the concerns I do have is how are we going to measure this 125 meters, specifically when you have carriers like ourselves that operate in multiple

environments and hold us to 125 meters? We didn't get an opportunity to discuss that, and I think that's something that we need to discuss in the future.

MR. SUGRUE: Well, I'll ask one last question. Maybe there's a quick answer to it. Bob Miller talked about being neutral for public safety and let me take a slightly different cut at that.

Are all these technologies transparent to the public safety people, I mean, that deliver -- does it impact on what you have to invest in or what the public safety answering people have to do, depending on which approach is taken?

MR. MILLER: We have really never cared what technology. We just simply want to locate all calls, including the N-initialized phone that the Commission wants us to handle. We certainly want to handle the roamers. we don't want a person to have a phone, no matter how great it is, that works in one state but not another state, so these are our issues.

You know, again, we don't care what technology. You know, this reverse TDOA, per se, I didn't hear about that until today and maybe next year we'll have another technology. It's just that we know we can locate -- maybe we won't locate every phone by 2001, but we know we can locate a lot of them.

MR. SUGRUE: Right, so, regardless of what technology is picked, there's not a cost impact one way or the other on the public?

MR. MILLER: Well, I think it depends on the issue that Jim brought up, cost recovery, you know. You may have to clarify that issue. I don't get the same read that Jim has that public safety's got to pay. I saw you saying there's got to be cost recovery for the carriers.

Now, if you're just going to do cost recovery for the new sets, that's one thing. But if you're going to do cost recovery for all phones, including the embedded base, and at some point in time we trade them out, that's another issue.

So if you compare apples with apples, you know, that's what we want, and I don't think it would matter a bit to us.

MR. SUGRUE: Joe?

MR. HANNA: I think sharing some of Bob's concerns, the most critical issue for those of us who run these centers, we want to locate the call. How the call gets there, how the information gets there is somewhat academic, as long as it comes in a standard format and then that becomes the key.

Under the current rule, there certainly are some issues, with implementation and cost issues, and I think

that's part of what this debate is all about. There certainly are issues as the rule is currently interpreted, as to how many people will be able to fully implement systems under the current guidelines and that becomes one of the issues we're trying to address here.

So what we're looking for is not really a technology issue, it's a movement issue. How do we move this process so that October 1, 2001 or whatever the date is, that we begin to see some progress. That's really, I think, what this issue is all about.

MR. MILLER: You're going to get back to us on the cost recovery issue, right?

MR. SUGRUE: Sure, you bet. We've got it worked out.

MR. HATFIELD: Any closing comments?

MR. RUDOKAS: Can I make two comments on cost recovery? One of them is, in a rural area, where we have very large cell sites that cover 1,000 square miles or such, it might be very difficult to figure out how one would pay for the equipment infrastructure, equipment to provide service in that area.

At the same time, it would be difficult to understand how we would be able to swap out all the handsets of our subscribers and pay for that.

The other issue is in urban areas. I wonder what

the issue is, or can we afford, as a nation, to build six or so overlapping location systems that all service the same area, and service essentially one population base? We may have six competing carriers in that area. It's very difficult to understand how that could actually work in an economic sense in large metro areas.

MR. HATFIELD: I'm really afraid we're running out of time here for a number of reasons. So Tom, Jim, do you have any further comment? I will remind you all that there is an opportunity for those in the audience who didn't get to participate to -- either on an ex parte basis or in response to the public notice, make further comments. Anything else?

If not, I'll just close by thanking you all again for coming here today. I think from my standpoint, at least, it's been very, very beneficial and, again, thank you.

(Whereupon, at 5:06 p.m., the hearing was concluded.)

//

//

//

//

//

//

REPORTER'S CERTIFICATE

FCC DOCKET NO.: N/A

CASE TITLE: E-911 AUTOMATIC LOCATION

HEARING DATE: June 28, 1999

LOCATION: Washington, D.C.

I hereby certify that the proceedings and evidence are contained fully and accurately on the tapes and notes reported by me at the hearing in the above case before the Federal Communications Commission.

Date: 6/28/99

Official Reporter
Heritage Reporting Corporation
1220 "L" Street, N.W.
Washington, D.C. 20005

TRANSCRIBER'S CERTIFICATE

I hereby certify that the proceedings and evidence were fully and accurately transcribed from the tapes and notes provided by the above named reporter in the above case before the Federal Communications Commission.

Date: 7-7-99

Official Transcriber
Heritage Reporting Corporation

PROOFREADER'S CERTIFICATE

I hereby certify that the transcript of the proceedings and evidence in the above referenced case that was held before the Federal Communications Commission was proofread on the date specified below.

Date: 7-7-99

Official Proofreader
Heritage Reporting Corporation